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ABSTRACT

Procedures for predicting academic achievement at Indiana University, Bloomington, are examined, based on data for the 4,145 freshmen who entered the university in fall 1983. Three sets of prediction equations and a graphic scheme for determining probable first semester grade point averages (GPAs) for males and females are provided. Entering freshman norms are included for Scholastic Aptitude Test (SAT) scores, relative high school rank (RHSR), and first and second semester GPAs. The best single predictor of GPA for both males and females is RHSR, but a weighted combination of SAT verbal, SAT math, and RHSR provides the most accurate prediction of GPA. The academic achievement of females is slightly more predictable than that of males. While males have higher SAT scores, females have higher grades at the university. The correlation between these students' first and second semester grades is also provided. An alternative procedure for estimating a student's likely achievement at the university enables the adviser to used graphs and a table to quickly estimate the likelihood of a student's obtaining GPAs in various ranges. Examples using the equations and the graphs are included. (SW)

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GPA PREDICTION PROCEDURES

AND

NORMATIVE DATA FOR FRESHMEN

Lucy Cheser Jacobs

INDIANA STUDIES IN HIGHER EDUCATION

NUMBER FIFTY-TWO

A Monograph of the

BUREAU OF EVALUATIVE STUDIES AND TESTING

INDIANA UNIVERSITY

BLOOMINGTON, INDIANA

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ABSTRACT

The 4,145 freshmen who entered the Bloomington campus of Indiana University in the Fall of 1983 were used to establish procedures for predicting academic achievement. Three sets of prediction equations and a graphic scheme for determining probable first semester grade point averages for males and females are provided. Entering freshman norms are included for SAT scores, high school relative rank, and first and second semester grade point averages.

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INTRODUCTION

Admissions officers at Indiana University have for a number of years used a combination of high school achievement and Scholastic Aptitude Test (SAT) scores to predict academic success in the freshman year. Because of the changing characteristics of student populations, grading systems, and the relationship among the predictor variables, it is necessary to update the prediction studies every few years. This monograph, the eighth in the series of updates, is based on the admissions data and first semester grades of 4,145 freshmen who entered the Bloomington campus in the fall of 1983.*

In addition to providing an updated procedure for predicting freshman academic performance at IUB, the monograph provides normative information on the SAT scores, the high school rank, and the first and second semester grades of the 1983 freshman class. The correlation between the students' first semester and second semester grades is also provided.

This publication is primarily developed for professional use by high school counselors, college admissions officers, and the academic advisors and administrators of Indiana University.

THE DATA BASE

Aptitude test scores are required as part of the admissions process at Indiana University-Bloomington. The principal aptitude test taken by applicants for admission to IUB is the Scholastic Aptitude Test. This test provides a measure of verbal aptitude (SATV) and a measure of mathematical aptitude (SATM). Each of these measures is reported on a scale of 200 to 800. The two scores may be summed to yield a total score (SATSUM) which ranges from 400 to 1600.

The second measure used in the prediction of scholastic achievement at IUB is a measure of previous academic achievement, namely rank in high school graduating class. In order to adjust for the variation in the size of the high schools that applicants attended, a student's rank in the high school graduating class (HSR) was divided by the size of the graduating class (HSS). The resulting proportion, multiplied by 100 and rounded to a whole number, is referred to as the relative high school rank (RHSR). The formula for relative high school rank is RHSR = HSR X 100. HSS

The smaller the RHSR, the higher the achievement level. A RHSR of 10, for example, indicates that a student was ranked in the top 10 percent of his/her graduating class.

The criterion of scholastic success used in the prediction procedure was the first semester grade-point average (GPA) at IUB. GPA is reported on a four-point scale where A = 4.0, B = 3.0, C = 2.0, D = 1.0, and F = 0.0.

*Only students who enrolled for at least 12 semester hours of credit were included.

EQUATIONS FOR PREDICTING GRADE POINT AVERAGES

Table 1 presents descriptive statistics for the 1983 entering freshmen on the variables involved in the prediction equation. Data are provided separately for males and females.

Table 1. Descriptive Statistics for Entering Freshmen at Indiana University-Bloomington in Fall, 1983.

Group	Variable	N of Cases	Mean	Standard Deviation	Correlation (r) with GPA	% of GPA Variance (r^2)
Females (N=2309)	SAT Verbal	2177	460	87.7	0.31	10
	SAT Math	2177	496	89.5	0.39	15
	SATSUM	2177	956	155.4	0.40	16
	RHSR	2262	19.8	14.7	-0.42	17
	GPA	2308	2.90	0.62	--	--
	Combination of SATV, SATM, and RHSR				0.50	25
Males (N=1719	SAT Verbal	1694	465	89.1	0.29	8
	SAT Math	1694	539	92.0	0.34	12
	SATSUM	1694	1004	157.6	0.36	13
	RHSR	1760	24.9	16.9	-0.41	17
	GPA	1825	2.82	0.65	--	--
	Combination of SATV, SATM, and RHSR				0.47	22

Table 1 shows the mean and standard deviation for each of four predictor variables. The correlation coefficient and the percent of GPA variance indicate the extent to which each variable is associated with academic achievement in college (GPA). For example, Table 1 shows that relative high school rank (RHSR) with an r of $-.42$ (females) and $-.41$ (males) is the single variable that has the highest correlation with GPA. It accounts for 17 percent of the variance in first semester GPAs.

The multiple correlation of the combination of SATV, SATM, and RHSR is also given. It can be seen that a combination of the three variables has the highest correlation with GPA and thus provides the most accurate prediction. The multiple correlations of .50 (females) and .47 (males) indicate that these three variables in combination account for 25 percent and 22 percent of the variance in GPA for females and males, respectively. The equations to be used for predicting first semester GPAs of male and female students are provided in Table 2.

Table 2. Three equations for predicting first semester grades at Indiana University - Bloomington.

GROUP	EQUATION	s_{est}
	Prediction with Relative Rank(RHSR) and SATs	
Female	PGPA=2.08133 - 0.01311 RHSR + 0.00080 SATV + 0.00141 SATM	.55
Male	PGPA=2.10729 - 0.01197 RHSR + 0.00078 SATV + 0.00119 SATM	.57
	Prediction with SATs only	
Female	PGPA=1.32748 + 0.00102 SATV + 0.00221 SATM	.57
Male	PGPA=1.29094 + 0.00109 SATV + 0.00189 SATM	.61
	Prediction with Relative Rank (RHSR) only	
Female	PGPA=3.24722 - 0.01791 RHSR	.57
Male	PGPA=3.20452 - 0.01573 RHSR	.59

The first set of equations which uses a weighted combination of SATV, SATM, and RHSR provides the optimum accuracy in predicting GPA. In order to determine a student's predicted GPA, one simply substitutes the student's SAT scores and RHSR into the appropriate equation. For example, assume a female student has the following scores: SATV = 460, SATM = 540, RHSR = 21.0. This student's predicted GPA would be 2.94. A male with SATV = 500, SATM = 680, and RHSR = 10.0 would be predicted to have a first semester GPA of 3.19.

Prediction always involves a margin of error. The standard error of estimate provided for each equation indicates the degree of error in the prediction. Approximately 68 percent of all students can be expected to obtain a GPA within plus and minus one standard error of estimate of their predicted GPA. For the female example above, the standard error of estimate of .55 indicates that 68 percent of females who had those particular predictor scores would be expected to receive a first semester GPA of 2.94 + .55. Thirty-two percent could be expected to receive GPAs outside this range.

The next set of prediction equations in Table 2 uses only SATV and SATM scores as predictors. The third set uses only RHSR. These equations are provided for use with those prospective students who do not furnish both SAT and RHSR.

A comparison of the standard errors of estimate for the various sets of equations indicates that the least amount of error is involved when the prediction is based on a combination of the three variables. It can also be seen that female achievement is somewhat more predictable (less error involved) than is the achievement of males.

GRAPHS FOR PREDICTING GRADE POINT AVERAGES

This section provides an alternative procedure for estimating a student's likely achievement at Indiana University. The most useful interpretation of predicted grade point average (PGPA) is in terms of a range of GPAs which the student is most likely to receive during his/her first semester at IUB. The following procedure provides an advisor with a quick method of obtaining the probability of a student's achieving in the different GPA ranges. The advisor who uses this procedure does not need to employ the equations in Table 2 to determine the probability of success for a prospective student.

The following five steps may be followed in order to determine the probability of a student's achieving within the various GPA categories during the first semester.

Step 1: Select the appropriate figure corresponding to the student's sex, Figure 1 for males or Figure 2 for females, and enter the figure with the two measures: SATSUM and the measure of high school achievement.

Step 2: SATSUM (SATV + SATM) ranging from 400 to 1600 is located on the horizontal axis of the figure. Move along the horizontal axis to the point that most closely corresponds to the student's SATSUM.

Step 3: The student's high school rank expressed on a decile scale (DHSR) ranging from 0 to 10 is on the vertical axis of the figure. Decile high school rank is computed by dividing the HSR by HSS and multiplying by 10 (round the resulting value). Move down the vertical axis to the point that most closely corresponds to the student's DHSR.

Step 4: The point on the figure where these two values (SATSUM and DHSR) intersect will give the student's probability letter group. The point of intersection will fall in one of four probability letter groups: Q, R, S or T. Consider both probability letter groups for borderline cases.

Step 5: Next go to Table 3 and locate the column corresponding to the student's probability letter group (Q,R,S,T). Under the column for the appropriate sex, read the probabilities for each of the GPA categories shown at the left.

Example

Jim has as SATSUM of 1150 (SATV = 570 and SATM = 580) and a DHSR of 3.3. Figure 1 places Jim in category S. Referring to the column labeled S for males in Table 3, one finds that only one percent of males like Jim obtained GPAs below 1.00, 9.1 percent obtained GPAs between 1.00 and 1.99, 54.5 percent between 2.00 and 2.99, and 35.4 percent between 3.00 and 4.00. In the lower part of the table, one sees that 89.9 percent of males like Jim obtained a first semester GPA of 2.00 or higher.

*Figures 1 and 2 are based on students for whom data for all variables were available.

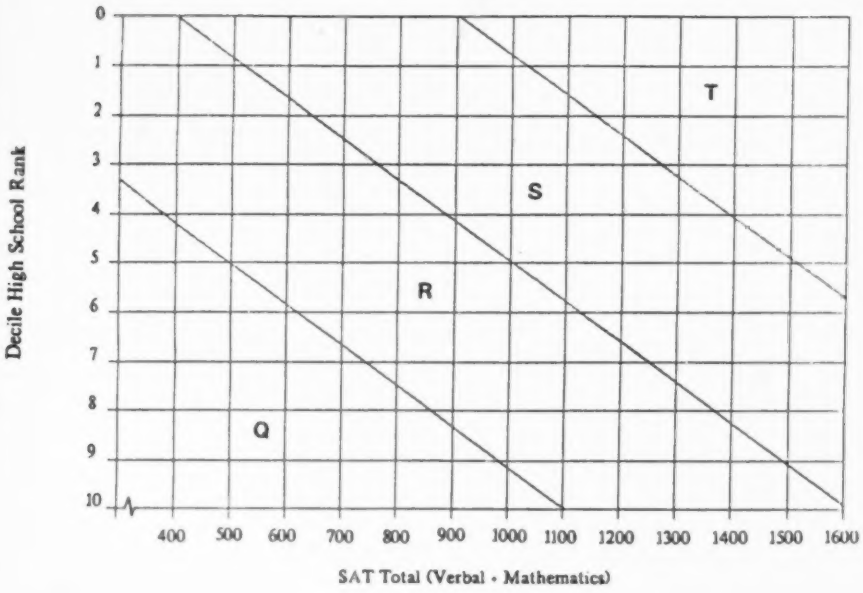

Figure 1. Predicted Achievement Categories for males.

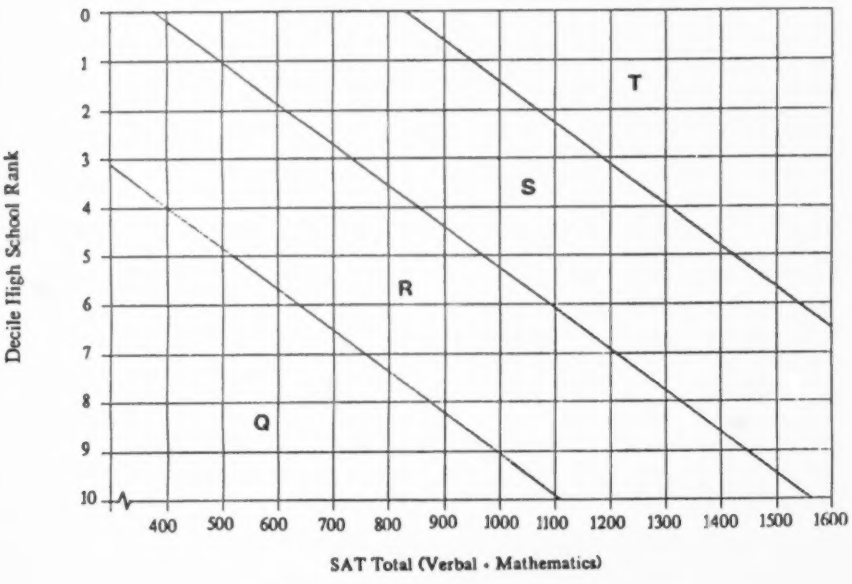

Figure 2. Predicted Achievement Categories for females.

Table 3. Percent of students in each probability letter group (Q, R, S, or T) according to the GPAs obtained during their first semester at Indiana University - Bloomington.

Obtained First Semester GPA	Predicted First Semester GPA Category							
	Q		R		S		T	
	Males	Females	Males	Females	Males	Females	Males	Females
3.00-4.00	10.0	0	12.0	13.9	35.4	35.8	67.8	70.7
2.00-2.99	80.0	40.0	69.0	64.6	54.5	54.4	28.8	26.5
1.00-1.99	10.0	40.0	17.8	20.7	9.1	9.4	3.4	2.6
0.00-0.99	0	20.0	1.2	.8	1.0	.3	0	.2
2.00 & Above	90.0	40.0	81.0	78.5	89.9	90.3	96.6	97.2
Below 2.00	10.0	60.0	19.0	21.5	10.1	9.7	3.4	2.8
N =	10	5	242	237	919	1091	475	811

NORMATIVE DATA

Distributions of RHSR and SAT scores are presented in Tables 4-7. Separate distributions are provided for males, females, and the total group. Advisors who wish to evaluate a prospective student's RHSR, SATV, SATM or SATSUM in relationship to the entering freshmen of 1983 on the Bloomington campus of IU can do so by referring to the appropriate normative group in Tables 4-7.

Table 4. Relative high school rank of entering freshmen at Indiana University-Bloomington in Fall 1983.

Relative High School Rank	Decile High School Rank	MALES N of Cases In Category	MALES % Below Category	FEMALES N of Cases In Category	FEMALES % Below Category	TOTAL N of Cases In Category	TOTAL % Below Category
0.01-5	1	194	89	371	84	565	86
5.01-10		188	78	353	68	541	73
10.01-15	2	220	66	317	54	537	59
15.01-20		176	56	260	43	436	48
20.01-25	3	191	45	223	33	414	38
25.01-30		163	36	203	24	366	29
30.01-35	4	169	26	156	17	325	21
35.01-40		142	18	140	11	282	14
40.01-45	5	102	12	94	6	196	9
45.01-50		83	8	73	3	156	5
50.01-55	6	44	5	32	2	76	3
55.01-60		25	4	14	1	39	2
60.01-65	7	19	3	12	1	31	1
65.01-70		18	2	6	-	24	1
70.01-75	8	10	1	2	-	12	1
75.01-80		7	1	0	-	7	-
80.01-85	9	2	-	4	-	6	-
85.01-90		2	-	2	-	4	-
90.01-95	10	3	-	0	-	3	-
95.01-100		2	-	0	-	2	-
Number		1760		2262		4022	
Mean		25		20		22	
Median		23		17		19	
Standard Deviation		17		15		16	

Table 5. Scholastic Aptitude Test-Verbal (SATV) scores of entering freshmen at Indiana University-Bloomington in Fall 1983.

Scores	MALES		FEMALES		TOTAL	
	N of Cases in Category	% Below Category	N of Cases in Category	% Below Category	N of Cases in Category	% Below Category
781-800	0	-	0	-	0	-
761-780	0	-	0	-	0	-
741-760	1	99	2	99	3	99
721-740	0	99	11	99	11	99
701-740	5	99	5	99	10	99
681-700	9	99	11	99	20	99
661-680	16	98	11	98	27	98
641-660	14	97	18	97	32	97
621-640	34	95	27	96	61	96
601-620	42	93	40	94	82	94
581-600	45	90	44	92	89	91
561-580	62	86	85	88	147	88
541-560	96	81	109	83	205	82
521-540	90	76	106	79	196	77
501-520	126	68	137	72	263	70
481-500	139	60	192	63	331	62
461-480	143	52	207	54	350	53
441-460	141	43	200	45	341	44
421-440	151	34	205	35	356	35
401-420	157	25	180	27	337	26
381-400	113	18	155	20	268	19
361-380	88	13	130	14	218	14
341-360	85	8	110	9	195	9
321-340	61	5	68	6	129	5
301-320	28	3	58	3	86	3
281-300	24	1	39	1	63	1
261-280	9	1	14	1	23	1
241-260	5	1	6	-	11	-
221-240	5	-	5	-	10	-
201-220	3	-	2	-	5	-
200	2	-	0	-	2	-
Number	1694		2177		3871	
Mean	465		460		462	
Median	460		460		460	
Standard Deviation	89		88		88	

Table 6. Scholastic Aptitude Test-Mathematics (SATM) scores of entering freshmen at Indiana University-Bloomington in Fall 1983.

Scores	MALES		FEMALES		TOTAL	
	N of Cases in Category	% Below Category	N of Cases in Category	% Below Category	N of Cases in Category	% Below Category
781-800	1	99	1	99	2	99
761-780	5	99	1	99	6	99
741-760	7	99	5	99	12	99
721-740	14	98	7	99	21	99
701-720	24	97	12	99	36	98
681-700	37	95	29	98	66	96
661-680	62	91	18	97	80	94
641-660	58	88	38	95	96	92
621-640	117	81	64	92	181	87
601-620	102	75	80	88	182	82
581-600	113	68	95	84	208	77
561-580	132	60	130	78	262	70
541-560	126	53	142	71	268	63
521-540	173	43	193	63	366	54
501-520	128	35	178	54	306	46
481-500	101	29	180	46	281	39
461-480	106	23	159	39	265	32
441-460	105	17	200	30	305	24
421-440	79	12	145	23	224	18
401-420	75	8	144	16	219	13
381-400	51	5	133	10	184	8
361-380	31	3	79	7	110	5
341-360	17	2	61	4	78	3
321-340	16	1	36	2	52	2
301-320	6	1	25	1	31	1
281-300	5	-	13	-	18	-
261-280	2	-	4	-	6	-
241-260	1	-	3	-	4	-
221-240	0	-	1	-	1	-
201-220	0	-	1	-	1	-
200	0	-	0	-	0	-
Number	1694		2177		3871	
Mean	539		496		515	
Median	540		500		520	
Standard Deviation	92		89		93	

Table 7. Scholastic Aptitude Test-Total scores of entering freshmen at Indiana University-Bloomington in Fall 1983.

Scores (SAT TOTAL)	MALES N of Cases in Category	MALES % Below Category	FEMALES N of Cases in Category	FEMALES % Below Category	TOTAL N of Cases in Category	TOTAL % Below Category
1561-1600	0	-	0	-	0	-
1521-1560	0	-	1	-	1	-
1481-1520	0	-	2	99	2	99
1441-1480	3	99	1	99	4	99
1401-1440	5	99	4	99	9	99
1361-1400	10	99	9	99	19	99
1321-1360	22	98	12	99	34	98
1281-1320	28	96	24	98	52	97
1241-1280	53	93	32	96	85	95
1201-1240	65	89	39	94	104	92
1161-1200	85	84	83	91	168	88
1121-1160	108	78	76	87	195	83
1081-1120	133	70	146	80	279	75
1041-1080	153	61	164	72	317	67
1001-1040	169	51	170	64	339	59
961-1000	164	41	212	55	376	49
921- 960	154	32	249	43	403	38
881- 920	144	24	242	32	386	28
841- 880	115	17	175	24	290	21
801- 840	102	11	166	17	268	14
761- 800	83	6	124	11	207	9
721- 760	50	3	93	7	143	5
681- 720	23	2	67	3	90	3
641- 680	12	1	39	2	51	1
601- 640	5	1	20	1	25	1
561- 600	3	-	10	-	13	-
521- 560	2	-	3	-	5	-
481- 520	2	-	1	-	3	-
441- 480	1	-	2	-	3	-
401- 440	0	-	0	-	0	-
Number	1694		2177		3871	
Mean	1004		956		977	
Median	1000		950		970	
Standard Diviation	158		155		158	

Table 8 summarizes the mean SAT scores of the entering freshmen at Indiana University and compares them with the national SAT averages.

Table 8. Indiana University and national norms on the Scholastic Aptitude Test (1983)

Test	Indiana University Entering Freshmen			National College Bound		
	MALES	FEMALES	TOTAL	MALES	FEMALES	TOTAL
SAT-VERBAL	465* (89)**	460 (88)	462 (88)	430	420	425
SAT-MATH	539 (92)	496 (89)	515 (93)	493	445	468
SAT-TOTAL	1004 (158)	956 (155)	977 (158)	923	865	894

*Mean
**Standard deviation in parentheses

Table 8 shows that the 1983 entering freshmen at IUB had higher mean scores on the SAT than did the national college bound sample. Among the IU freshmen, the males had higher average scores than the females on both the SATV and the SATM. Table 4 shows, however, that freshman females at IUB ranked, on the average, five percent higher in their high school classes. Tables 9 and 10 present distributions of the first and second semester grades (GPAs) obtained by the 1983 entering freshmen. Data in Tables 9 and 10 may be helpful in interpreting students' predicted GPAs.

Tables 9 and 10 show that second semester grades averaged slightly lower than first semester grades for both males and females. Female students received higher average grades than males both semesters.

Table 9. First semester grades of entering freshmen at Indiana University-Bloomington in Fall 1983

GPA	MALES		FEMALES		TOTAL	
	N of Cases in Category	% Below Category	N of Cases in Category	% Below Category	N of Cases in Category	% Below Category
4.00	23	99	36	98	59	99
3.90-3.99	37	97	54	96	91	96
3.80-3.89	47	94	64	93	111	94
3.70-3.79	60	91	96	89	156	90
3.60-3.69	71	87	78	86	149	86
3.50-3.59	66	83	102	81	168	82
3.40-3.49	78	79	79	78	157	78
3.30-3.39	84	75	139	72	223	73
3.20-3.29	94	69	128	66	222	68
3.10-3.19	88	65	143	60	231	62
3.00-3.09	113	58	169	53	282	55
2.90-2.99	103	53	147	47	250	49
2.80-2.89	119	46	155	40	274	43
2.70-2.79	97	41	117	35	214	37
2.60-2.69	100	35	120	30	220	32
2.50-2.59	90	30	110	25	200	27
2.40-2.49	88	26	113	20	201	22
2.30-2.39	87	21	87	16	174	18
2.20-2.29	68	17	71	13	139	15
2.10-2.19	72	13	45	11	117	12
2.00-2.09	59	10	63	8	122	9
1.90-1.99	35	8	41	7	76	7
1.80-1.89	28	7	33	5	61	6
1.70-1.79	28	5	30	4	58	4
1.60-1.69	28	3	21	3	49	3
1.50-1.59	22	2	16	2	38	2
1.40-1.49	10	2	14	2	24	2
1.30-1.39	6	1	12	1	18	1
1.20-1.29	3	1	6	1	9	1
1.10-1.19	6	1	5	1	11	1
1.00-1.09	2	-	6	-	8	1
.01- .99	10	-	7	-	17	-
0	3		1	-	4	-
Number	1825		2308		4133	
Mean	2.82		2.90		2.86	
Median	2.30		2.40		2.40	
Standard Deviation	.65		.62		.64	

Table 10. Second semester grades of entering freshmen at Indiana University-Bloomington in Fall 1983.

Second Semester GPA	MALES N of Cases in Category	MALES % Below Category	FEMALES N of Cases in Category	FEMALES % Below Category	TOTAL N of Cases in Category	TOTAL % Below Category
4.00	28	98	42	98	70	98
3.90-3.99	36	97	39	96	75	96
3.80-3.89	45	94	56	94	101	94
3.70-3.79	59	91	74	91	133	91
3.60-3.69	52	88	68	88	120	88
3.50-3.59	65	84	86	84	151	84
3.40-3.49	70	80	98	80	168	80
3.30-3.39	70	77	135	74	205	75
3.20-3.29	73	72	111	69	184	70
3.10-3.19	67	69	110	64	177	66
3.00-3.09	101	63	139	58	240	60
2.90-2.99	84	59	132	52	216	55
2.80-2.89	102	53	128	46	230	49
2.70-2.79	81	48	126	41	207	44
2.60-2.69	103	43	131	35	234	38
2.50-2.59	109	37	115	30	224	33
2.40-2.49	90	32	115	25	205	28
2.30-2.39	94	26	90	21	184	23
2.20-2.29	72	22	79	17	151	20
2.10-2.19	65	19	83	14	148	16
2.00-2.09	76	15	60	11	136	13
1.90-1.99	54	12	53	9	107	10
1.80-1.89	36	10	39	7	75	8
1.70-1.79	40	7	33	6	73	6
1.60-1.69	25	6	26	5	51	5
1.50-1.59	26	5	24	3	50	4
1.40-1.49	18	4	17	3	35	3
1.30-1.39	13	3	11	2	24	3
1.20-1.29	7	3	12	2	19	2
1.10-1.19	7	2	6	1	13	2
1.00-1.09	10	2	11	1	21	1
.01- .99	24	-	20	-	44	1
0	4	-	0	-	4	-
Number	1806		2269		4075	
Mean	2.72		2.81		2.77	
Median	2.20		2.30		2.30	
Standard Deviation	.71		.67		.69	

CORRELATION BETWEEN FIRST AND SECOND SEMESTER GRADES

Table 11 shows the correlation between the freshman students' first semester grades and the grades they received during the second semester.

Table 11. Correlation between first and second semester GPAs for Indiana University freshmen 1983-84

	Correlation	% of Second Semester GPA Variance (r^2)
Females (N=2277)	.62	38
Males (N=1813)	.64	41
Total (N=4090)	.63	40

Table 11 indicates that there was a substantial positive correlation between the grades students received during the first semester 1983-84 and the grades they received during the second semester. The correlation was slightly higher for males than for females. For the total group, approximately 40 percent of the variance in second semester grades can be accounted for by the student's academic performance during the first semester.

SUMMARY AND DISCUSSION

The purpose of this monograph is to provide an update in the series of studies involving the prediction of scholastic success in the freshman year at Indiana University-Bloomington. The sample for the present study consisted of the 4,145 freshmen who entered IUB in the Fall, 1983. SAT scores and/or relative high school rank were used to predict first semester GPAs. Three sets of equations each using different predictors were provided. The best single predictor of GPA for both males and females is relative high school rank, but a weighted combination of SATV, SATM, and RHSR provides the most accurate prediction of GPA. The academic achievement of females is slightly more predictable than that of males.

Graphs and a table also furnish an alternative procedure for predicting the probable success of a student at IUB during his/her first semester. Using the graphs and accompanying table, an advisor can estimate the likelihood of a student's obtaining GPAs in various ranges.*

In addition to providing the prediction procedures, the present monograph includes normative data on SATV, SATM, SATSUM, RHSR, and first and second semester GPAs for the 1983 entering freshmen. While males had higher SAT scores, females made higher grades at the University. The correlation between these students' first semester and second semester grades at IUB is also provided.

*If assistance is needed in the use of the prediction procedures or in the interpretation of the predicted grade point averages, please call the Bureau of Evaluative Studies and Testing. (Phone: 812/335-1595)